

# How the Discovery Process Works

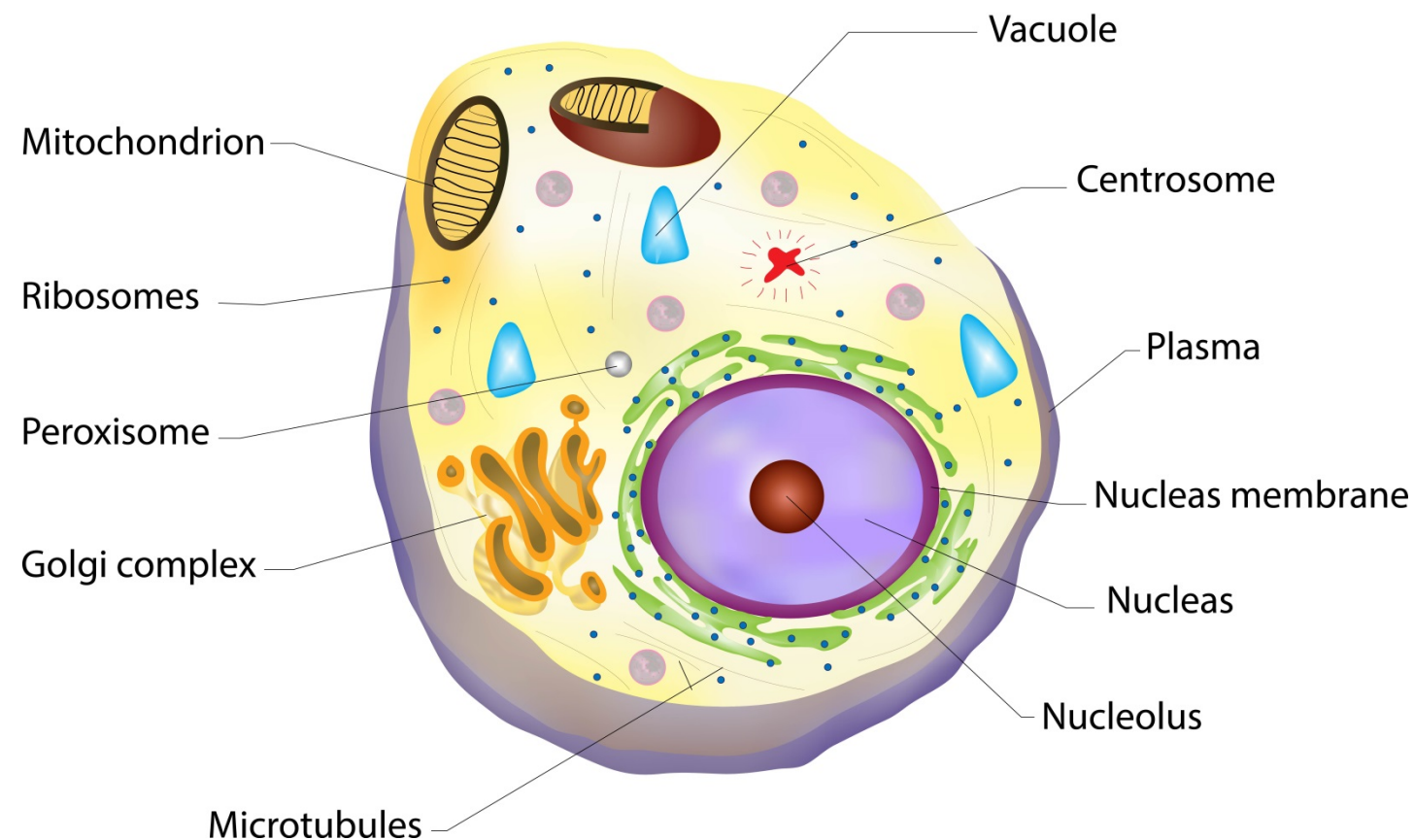
## (Part 2: Cell vs. Cell Phone)

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# What Is Scientific Research?

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How does research on a cell differ from that of a cell phone?



# Research Required for Cell Phone (Theoretical & Applied)

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- Physics
- Chemical
- Materials
- Computer
- Software
- Electrical
- Micro-electronics
- Aerospace
- Etc.



# Theoretical Physics vs. Applied Physics

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## Theoretical Physics

- Uses mathematical models to explain and predict natural phenomena

$$\begin{aligned}\left(\nabla^2 - \mu\epsilon\frac{\partial^2}{\partial t^2}\right)\mathbf{E} &= 0 \\ \left(\nabla^2 - \mu\epsilon\frac{\partial^2}{\partial t^2}\right)\mathbf{B} &= 0\end{aligned}$$

where

$$c = \frac{1}{\sqrt{\mu\epsilon}}$$



## Inventing the Radio & Cell Phone

## Applied Physics

- Uses experimental tools to test natural phenomena; resulting in technology



- In the 1860s mathematical equations were developed that described electromagnetic waves (such as radio waves).
- Around 50 years later the first radio was invented, ultimately resulting in cell phones.

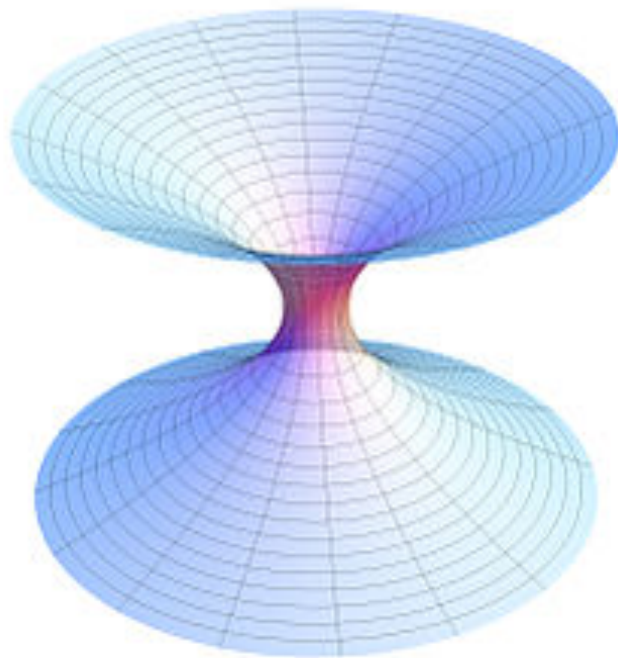




# Theoretical Physics vs. Applied Physics

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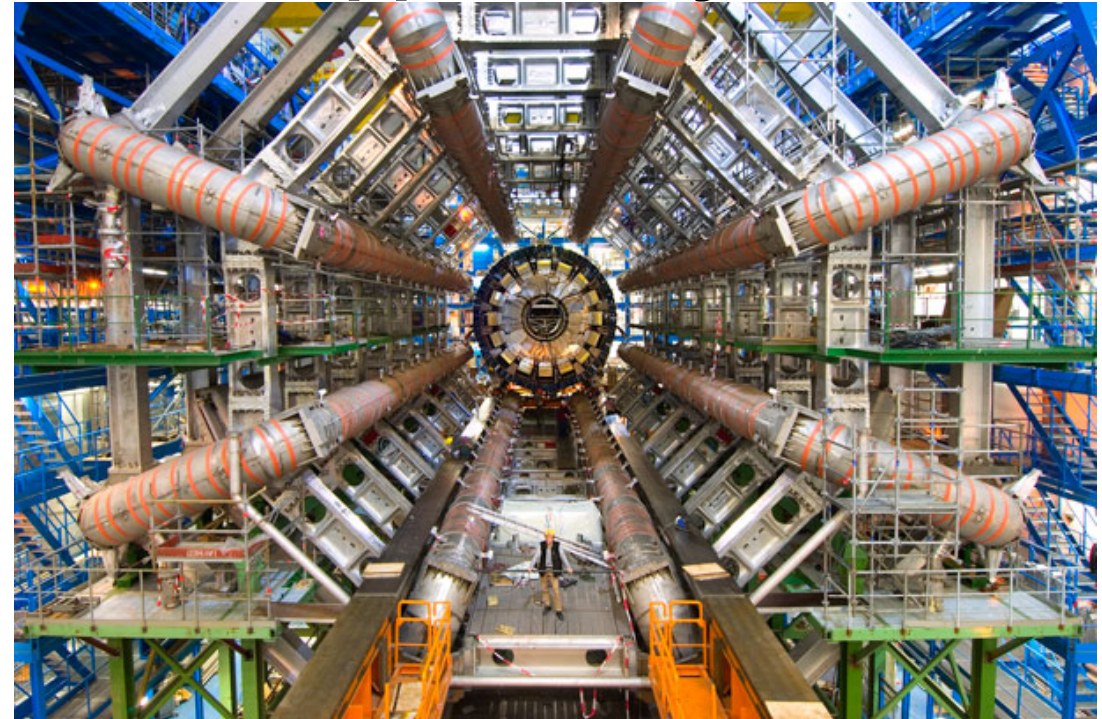
## Theoretical Physics



### Wormhole

Wormholes have never been observed, but they are predicted to exist through mathematical models.

## Applied Physics



### Hadron Particle Collider

